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How can division of labour in social insects evolve?

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How can division of labour in social insects evolve from scratch?

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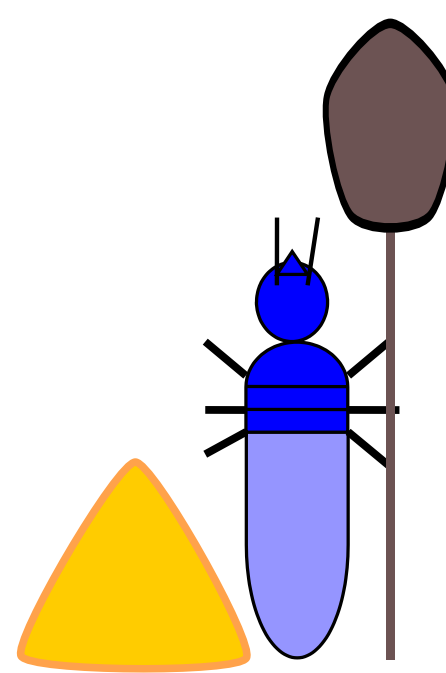
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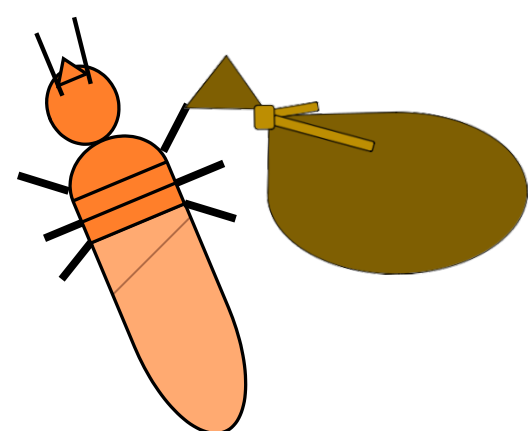


DFG Deutsche Forschungsgemeinschaft

Aims and approach



builders

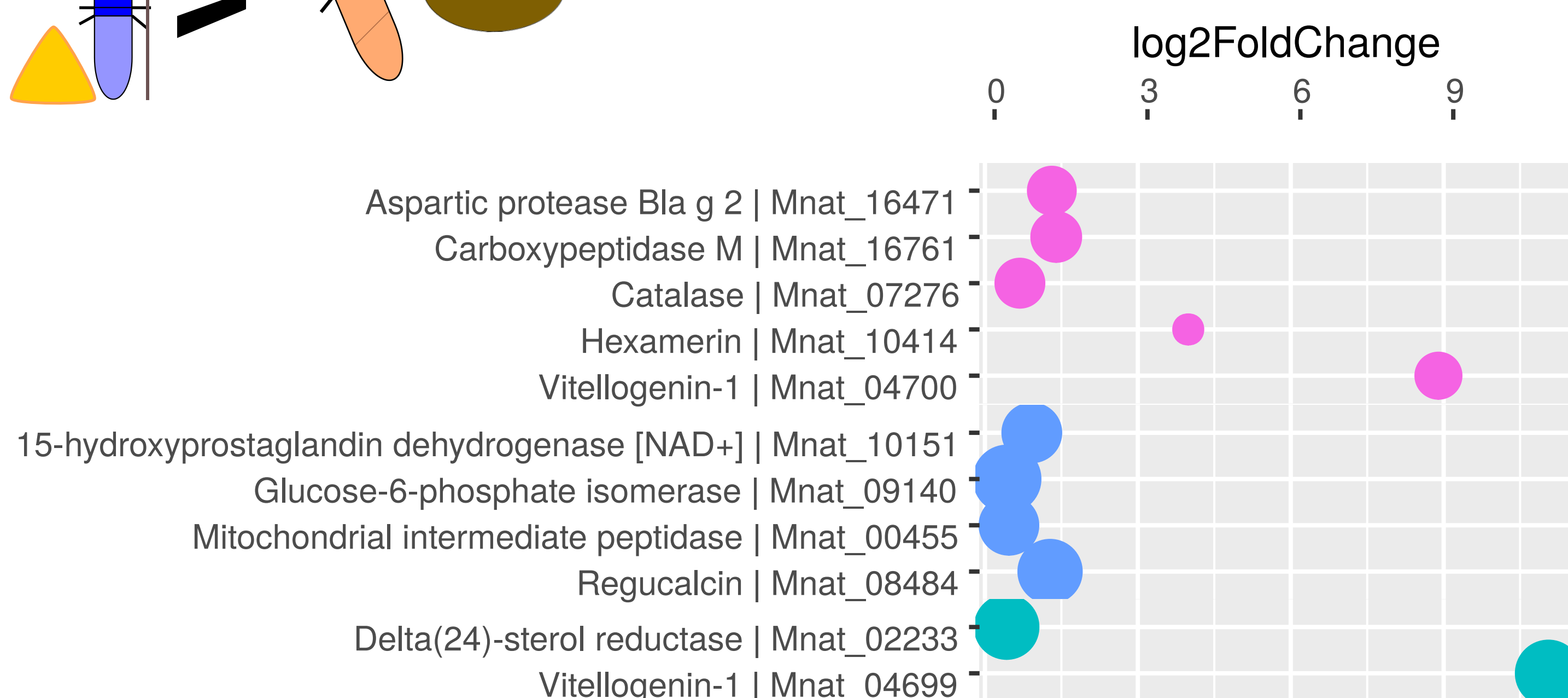
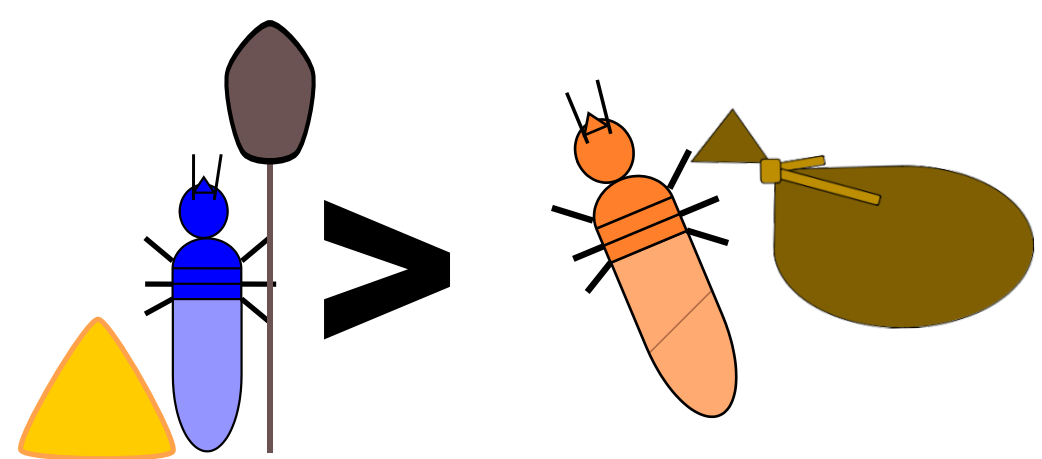


foragers

Division of Labour (DOL) is a hallmark of social evolution. The emergence of DOL in insect workers is easy to understand in morphologically distinct castes performing diverse tasks. In the same morphological caste it is not immediately self-evident. Here we studied DOL in the socially complex termite *Macrotermes bellicosus*, where minor workers show behavioural polyethism as builders and foragers¹.

To investigate the genes underlying DOL, we did transcriptome analysis comparing age controlled builders and foragers. We analyzed differentially expressed genes (DEGs).

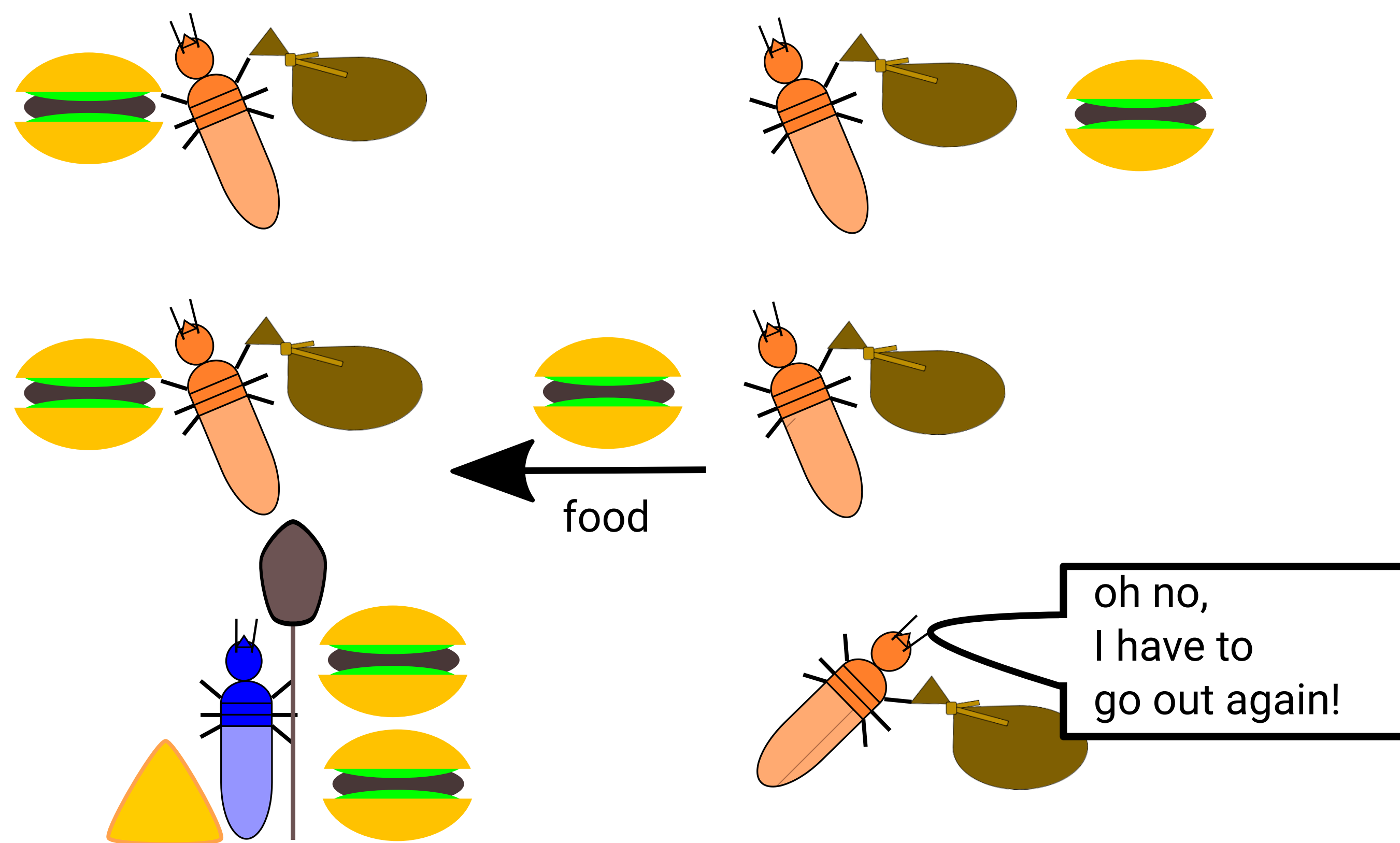
Genes upregulated in builders



We found *vitellogenin* (2 copies) and *hexamerin* upregulated in builders compared to foragers. These genes were also upregulated in reproductives compared to non-reproductives. These DEGs have functions related to social organization, but at the same time the proteins encoded by these genes are storage proteins^{2,3}.

Conclusion: Builders are more similar to reproductives than foragers. Foragers are characterized by low expression of genes encoding storage proteins.

Emergence and maintenance of DOL by a feedback loop



The DEGs indicate a natural connection to foraging. Foraging could be a behaviour that is regulated by a self-reinforcing feedback loop. Because foragers share their food to the colony, they themselves are constantly starved and motivated to continue foraging. Natural selection could then lead to a further stabilization of DOL.

Reference 1: Lys JA, Leuthold RH (1991). Insectes Soc., 38, 161–170.

Reference 2: Pan ML, Bell WJ, Telfer WH (1969) Science, 165, 393–394.

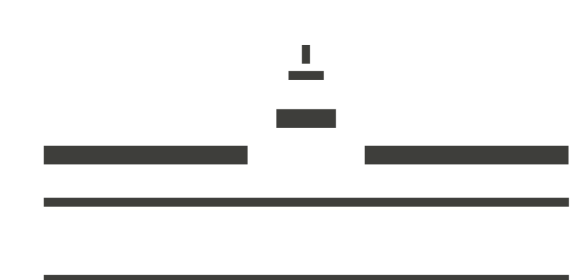
Reference 3: Burmester T (2002) J. Comp. Physiol. B, Biochem. Syst. Environ. Physiol., 172, 95–107.



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